WiNG 5.X How-To Guide

WiNG 4.X Access Point Migration

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1. Introduction

This guide is intended to provide the reader with recommendations and examples for how to upgrade AP300 and AP650 Dependent and AP7131 Independent Access Points from WiNG 4 environments to WiNG 5.2. This guide provides upgrade procedures in addition to considerations and examples. Procedures and examples for migration RFSX000 series Wireless Controllers from WiNG 4 to WiNG 5.2 is provided in a separate guide.

1.1 Upgrading Access Point Firmware

The following section provides details and procedures for upgrading Dependent / Independent Access Points to WiNG version 5.2 or higher. WiNG version 5.2 firmware images are available to registered users for download on the Motorola Solutions Technical Support website by visiting http://support.symbol.com.

1.1.1 AP300 Dependent Access Points

AP300 Dependent Access Points firmware is embedded in the Wireless Controllers firmware image and is automatically upgraded / downgraded to match the firmware version running on the Wireless Controller. AP300 Dependent Access Point support is provided in various software steams including WiOS, WiNG 3.x, WiNG 4.x as well as WiNG version 5.2 or higher.

The AP300 Dependent Access Points can be discovered and adopted by a Wireless Controller running WiNG version 5.2 (or higher) at Layer 2 or Layer 3. However unlike the AP650 Dependent or AP7131 Independent Access Points which support the WiNG 5.0 MiNT protocol, the AP300 Dependent Access Points will continue to use the legacy WiSPe protocol and operate in the same manner and support a similar feature set as provided in WiNG 4.0.

In addition the management of the AP300 Dependent Access Points in WiNG version 5.2 or higher differs from how the AP650 Dependent or AP7131 Independent Access Points are managed. The AP300 Dependent Access Points do not support profiles and are managed directly under the Wireless Controller they are adopted to.

1.1.1.1 Upgrade Paths

AP300 Dependent Access Points are widely deployed and are supported on various platforms including the WS2000, WS5000, WS5100 and RFSX000 series Wireless Controllers. For the AP300 Dependent Access Points to be supported in WiNG version 5, the RFSX000 series Wireless Controllers must be running a minimum version of WiNG 5.2 or higher.

RFSX000 series Wireless Controllers with AP300 Dependent Access Points running WiNG version 4.3.x (anchor release) or higher can be directly upgraded to WiNG 5.2. However AP300 Dependent Access Points managed by Wireless Controllers running older WiOS or WiNG software releases will require a stepped upgrade to be supported. The AP300 Dependent Access Points in these cases will need to be adopted by a Wireless Controller running the appropriate anchor firmware version so that the WiSPe firmware on the AP300 Dependent Access Points can be upgraded to a version that is compatible with WiNG 5.2.

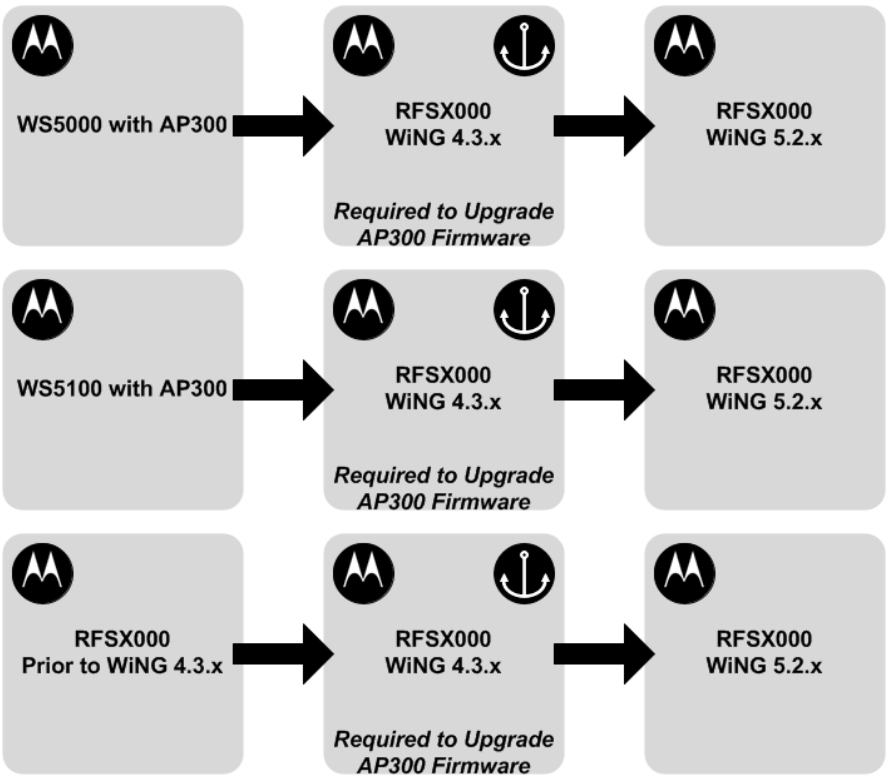


Figure 1.1.1.1 – AP300 Dependent AP Upgrade Paths

Note – AP300 Dependent Access Points will be automatically downgraded if they adopt to a Wireless Controller running older WiNG firmware. To prevent accidental downgrades, verify that there are no Wireless Controllers running older firmware on the AP300 Dependent Access Points Native VLAN. Also verify that the DHCP option 189 or 191 supplied to the AP300 Dependent Access Points do not include any IP Addresses of Wireless Controllers running older firmware releases.

1.1.2 AP650 Dependent Access Points

AP650 Dependent Access Points firmware is embedded in the Wireless Controllers firmware image and is automatically upgraded / downgraded to match the firmware version running on the Wireless Controller. AP650 Dependent Access Point support is provided in various software steams including WiNG 4.0 as well as WiNG version 5.2. The AP650 Dependent Access Points can be discovered and adopted by a Wireless Controller at Layer 2 or Layer 3.

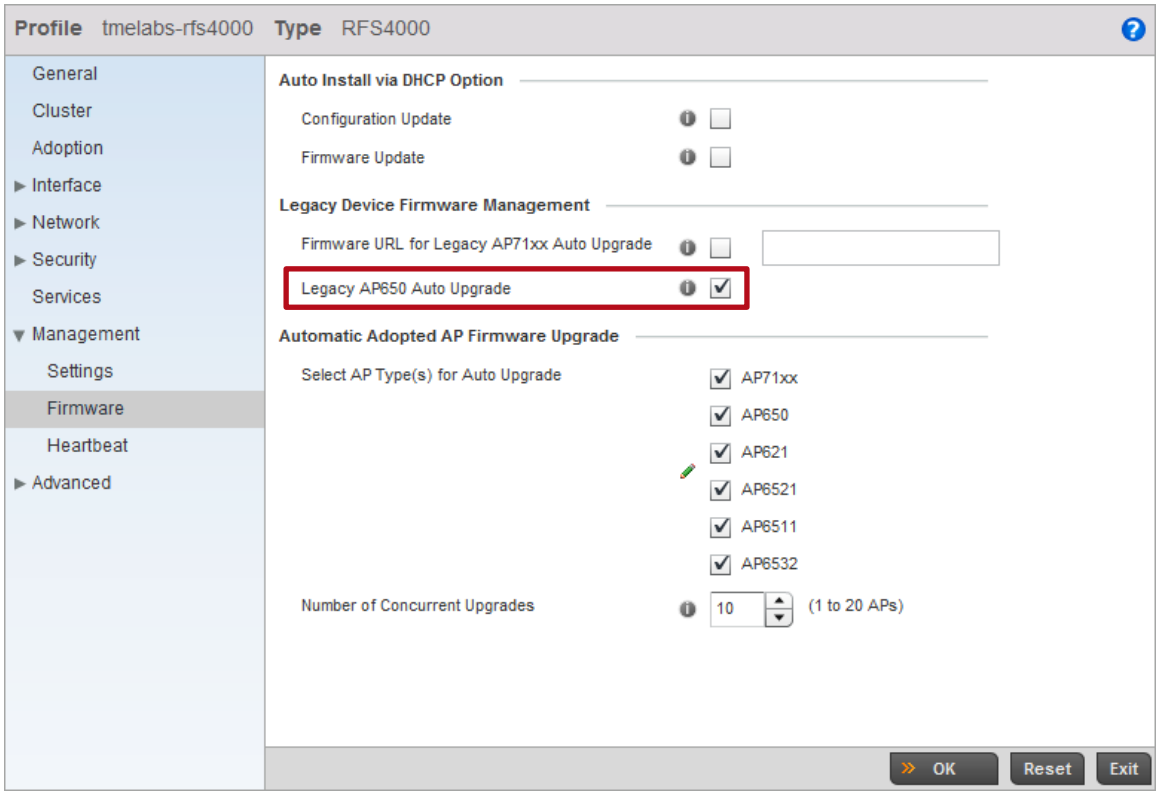
By default a Wireless Controller running WiNG 5.2 will automatically upgrade an AP650 Dependent Access Point running WiNG 4.3 or higher using a WISPe firmware upgrade. This option is enabled by default using the ***legacy-auto-update*** parameter assigned to the Wireless Controllers profile. The Wireless Controller will first adopt the AP650 Dependent Access Points using the WISPe protocol and will then download the embedded WiNG 5.2 image converting the AP650 Dependent Access Points to WiNG 5.2.

The ***legacy-auto-update*** parameter is enabled in the Wireless Controllers profiles by default. If the ***legacy-auto-update*** parameter has been disabled, it can be re-enabled using the Command Line Interface (CLI) or Web Based User Interface (Web-UI):

Command Line Interface:

```
RFSx000-1# configure terminal
RFSx000-1(config)# profile rfs4000 tmelabs-rfs4000
RFSx000-1(config-profile-tmelabs-rfs4000)# legacy-auto-update
RFSx000-1(config-profile-tmelabs-rfs4000)# commit write
```

Configuration → Profile-Name → Edit → Management → Firmware:



1.1.2.1 Upgrade Paths

RFSX000 series Wireless Controllers managing AP650 Dependent Access Points must be running the minimum version of WiNG 4.3 of higher before they can be upgraded to WiNG 5.2. RFSX000 series Wireless Controllers with AP650 Dependent Access Points already running WiNG version 4.3 or higher can be directly upgraded to WiNG 5.2, however RFSX000 series Wireless Controllers with AP650 Dependent Access Points running older WiNG 4.0 releases must be first upgraded to the WiNG 4.3 anchor release prior to being upgraded to WiNG 5.2.

Figure 1.1.2.1 – AP650 Dependent AP Upgrade Paths

Note – AP650 Dependent Access Points will be automatically downgraded if they adopt to a Wireless Controller running older WiNG firmware. To prevent accidental downgrades, verify that there are no Wireless Controllers running older firmware on the AP650 Dependent Access Points Native VLAN. Also verify that the DHCP option 189 or 191 supplied to the AP650 Dependent Access Points do not include any IP Addresses of Wireless Controllers running older firmware releases.

1.1.3 AP7131 Independent Access Points

AP7131 Independent Access Points running WiNG 4.1.1.x or higher firmware require a migration image (.bin) that will upgrade the AP7131 Independent Access Points to WiNG 5.2. Unlike the AP300 / AP650 Dependent Access Points, the AP7131 Independent Access Points firmware image is not embedded in the Wireless Controllers firmware image. The migration image must be downloaded and installed separately.

Access Point Model	Migration Firmware Image
AP7131	AP71XX-5.X.X.X-0XXR.bin

The AP7131 Independent Access Points migration image is release specific and is available for each WiNG 5.0 release. The migration image version installed on the AP7131 Independent Access Points must match the WiNG 5.0 version running on the Wireless Controller.

1.1.3.1 Upgrade Paths

Before an AP7131 Independent Access Point can be upgraded to WiNG 5.2, it must be running a minimum WiNG firmware version of 4.1.1.x or higher. If the AP7131 Independent Access Point is running an older WiNG 4 release, it must first be upgraded to the anchor release of WiNG version 4.1.1.x or higher before the migration image can be installed. A direct upgrade from older WiNG releases is not supported and will cause the upgrade to fail.

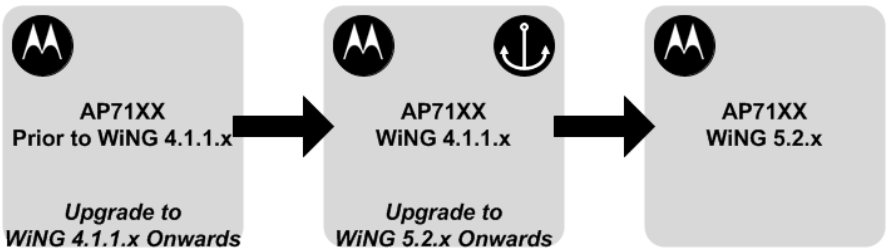


Figure 1.1.3.1 – AP71XX Upgrade Paths

1.1.3.2 Config Migration

AP7131 Independent Access Points running WiNG 4 maintain their own local configuration and certain configuration parameters are maintained during the migration to WiNG 5. Configuration parameters that are migrated from WiNG 4 to 5 include:

- Hostname
- PHY Configuration (Speed and Duplex)
- VLAN Port Membership and Tagging
- Default Gateway
- LAN and WAN Static IP Addressing
- Controller IP Addresses

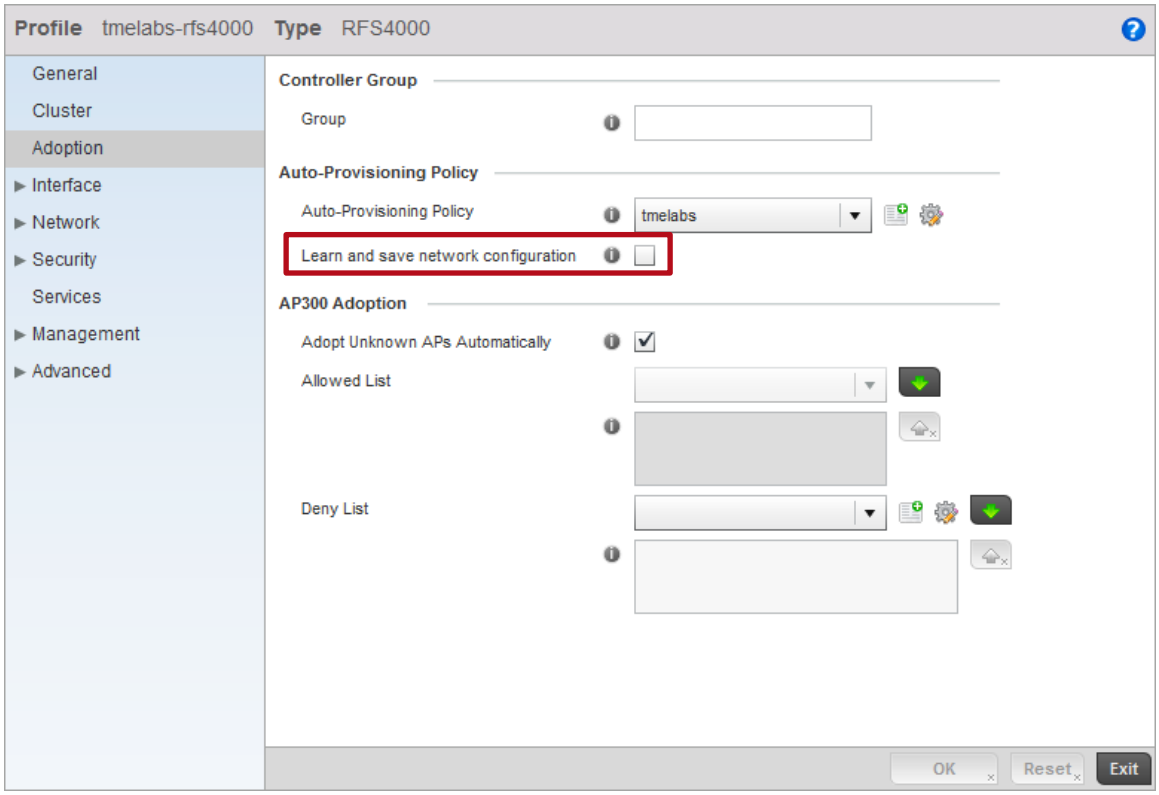
By default the Wireless Controller running WiNG 5.2 or higher will learn these configuration parameters upon initially adopting an AP7131 Independent Access Point and will add the migrated parameters to the AP7131 Independent Access Points device configuration as overrides. This behavior is controlled using the ***auto-learn-staging-config*** parameter which is enabled by default in the Wireless Controllers profile.

For WiNG 5.2 deployments where AP7131 Dependent Access Points are pre-staged prior to deployment, it is recommended that the ***auto-learn-staging-config*** parameter remain enabled so that hostnames, VLAN and IP addressing configuration can be maintained upon initial adoption. However if the AP7131 Dependent Access Points are to be centrally managed and configured, it is recommended that the ***auto-learn-staging-config*** parameter be disabled. The ***auto-learn-staging-config*** parameter can be disabled using the Command Line Interface (CLI) or Web Based User Interface (Web-UI):

Command Line Interface:

```
RFSx000-1# configure terminal
RFSx000-1(config)# profile rfs4000 tmelabs-rfs4000
RFSx000-1(config-profile-tmelabs-rfs4000)# no auto-learn-staging-config
RFSx000-1(config-profile-tmelabs-rfs4000)# commit write
```

Configuration → Profile-Name → Edit → Management → Firmware:



1.1.3.3 Firmware Upgrade Examples

AP7131 Independent Access Points can be upgraded to WiNG 5.2 or higher using various methods including manually from a centralized FTP / TFTP server, automatically from the Wireless Controller or automatically from a centralized TFTP server using AutoInstall.

1.1.3.3.1 Manual Upgrades

AP7131 Independent Access Points can be manually upgraded using the AP7131 Independent Access Points Command Line Interface (CLI) or Web User Interface (Web-UI). With a manual upgrade the migration image is stored on a local or centralized TFTP, FTP or SFTP server and is downloaded directly by the AP7131 Independent Access Points. The server IP address, migration image filename, migration image path and credentials are manually defined on the AP7131 Independent Access Points using the CLI or Web-UI and the upgrades are manually initiated.

Manual firmware upgrades can be used to upgrade AP7131 Independent Access Points using either static or dynamic IP addressing and is useful when upgrading a small number of devices. Manually initiated upgrades are also commonly utilized by third-party management tools that use SNMP or CLI to manage the AP7131 Independent Access Points.

1.1.3.3.1.1 CLI Example

The following example outlines how to manually upgrade an AP7131 Independent Access Point running the WiNG 4 anchor release to WiNG version 5.2 or higher using the CLI:

1 **_Login_ to the AP7131 Independent Access Point then enter the _Firmware Update_ configuration context:**

```
admin> system
admin(system)> fw-update
```

2 **Define the _TFTP Server IP Address_, _Migration Image Name_ and _Path_:**

```
admin(system.fw-update)> set server 192.168.10.10
admin(system.fw-update)> set file AP7131-5.2.1.0-021R.bin
admin(system.fw-update)> set path Motorola/WiNG5/5.2.1.0-021R/
```

3 **Verify the _Parameters_:**

```
admin(system.fw-update)> show

automatic firmware upgrade        : enable
automatic config upgrade          : enable

firmware filename                 : AP7131-5.2.1.0-021R.bin
firmware filepath                 : Motorola/WiNG5/5.2.1.0-021R/
ftp/sftp/tftp server ip address   : 192.168.10.10
ftp/sftp user name                :
ftp/sftp password                 : ********
```

4 Initiate the *TFTP Firmware Upgrade*:

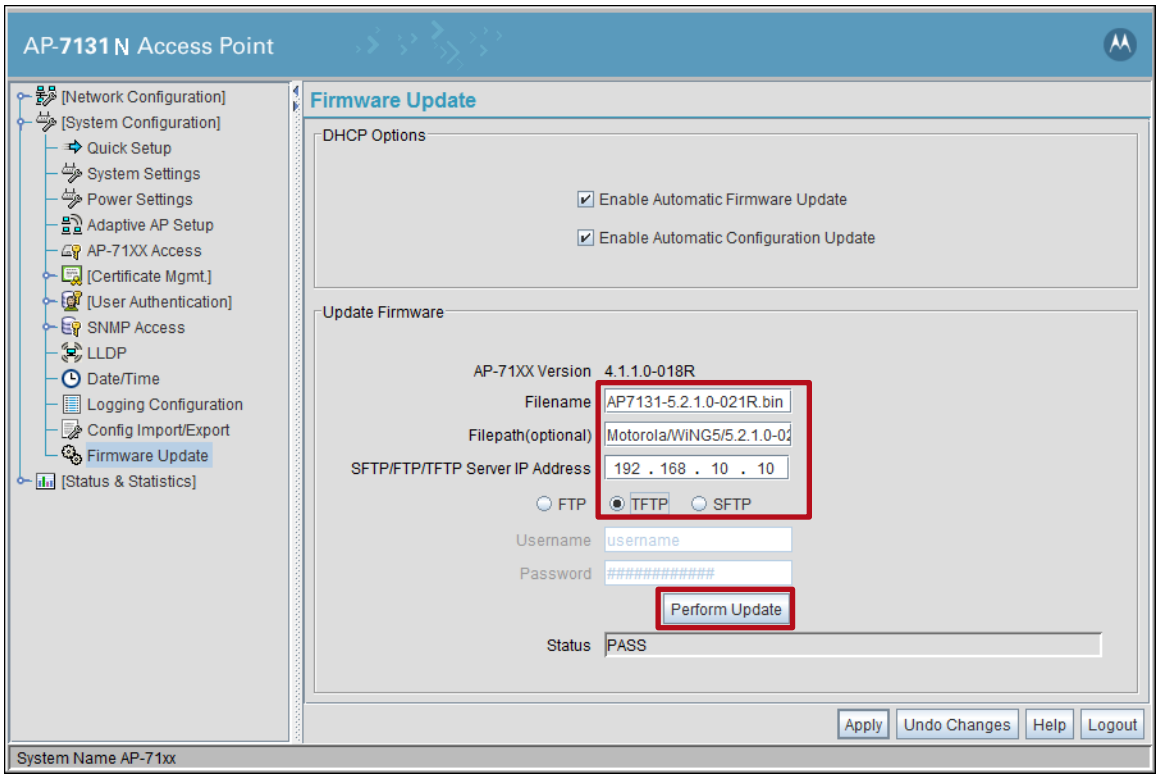
```
admin(system.fw-update)> update tftp

**************************************************************************
System will now download firmware then reset for upgrade.  Do not
power off the AP during the firmware upgrade process (5-6 minutes).
**************************************************************************
```

1.1.3.3.1.2 Web User Interface Example

The following example outlines how to upgrade an AP7131 Independent Access Point running the WiNG 4 anchor release to 5.2 or higher using the Web-UI:

1 Login to the Access Point then select *System Configuration* → *Firmware Update*. Define the *TFTP Server IP Address*, *Migration Image Name* and *Path* then select *Perform Update*:



1.1.3.3.2 Automatic Upgrades via AutoInstall

AP7131 Independent Access Points can be automatically upgraded to WiNG 5.2 or higher using DHCP options supplied to the AP7131 Independent Access Points from a local or centralized DHCP server. With AutoInstall the migration image is stored on a local or centralized TFTP server and the DHCP options instruct the AP7131 Independent Access Points where to locate the migration firmware image file. If the firmware version on the TFTP server is newer that the firmware version currently installed, the AP7131 Independent Access Points will download and install the new firmware.

The AP7131 Independent Access Point migration image is approximately 34Mb in size and for distributed branch deployments over a WAN it is recommended that a local TFTP server be deployed at each site to perform the initial migration. In most cases the remote branch site will already have an existing TFTP server deployed to support handheld devices or site operations. Alternatively existing network infrastructure at the remote site such as a Router can also be used to provide the TFTP file transfer services. Once the AP7131 Independent have been migrated to WiNG 5.2, further upgrades are distributed though the elected RF Domain Manager for each site.

AutoInstall can only be used to upgrade AP7131 Independent Access Points using dynamic IP addressing and is especially useful when upgrading a large number of Access Points. Upgrades can be performed on all AP7131 Independent Access Points at the same time or on a per building, site or floor basis.

Once the Motorola DHCP options and values have been defined on the DHCP server, the firmware upgrade is initiated by resetting the AP7131 Independent Access Points. Upon booting and obtaining network addressing, the AP7131 Independent Access Points will contact the TFTP server and download the specified migration image.

The following table highlights the Motorola DHCP options required for AutoInstall:

Option	Description	Format	Example
186	FTP / TFTP Server IP Address	ASCII or String	192.168.21.10
187	Firmware Image Name & Path	ASCII or String	5.2.1.0-021R/AP7131-5.2.1.0-021R.bin

Table 1.1.3.3.2-1 – AutoInstall DHCP Options

Depending on the DHCP server's capabilities, the Motorola DHCP options maybe assigned to individual DHCP scopes or globally across all DHCP scopes. Individual DHCP scope assignment requires the specific Motorola DHCP options and values to be assigned to each DHCP scope that is servicing the AP7131 Independent Access Points. If a large number of DHCP scopes are defined, some enterprise DHCP servers provide the ability to assign options and values globally which will be applied to all the DHCP scopes serviced by the DHCP server.

If the enterprise includes other network devices such as Printers or IP Phones that require the same DHCP options, DHCP option 60 (Vendor Class Identifier) can be utilized to supply the Motorola DHCP options and values to only to the AP7131 Independent Access Points. AP7131 Independent Access Points running WiNG 4 and WiNG 5 will supply a specific option 60 value to the DHCP server (based on its WiNG firmware version) with the DHCP discover and ACK message. This value can be filtered by the DHCP server and used to only supply the migration image path and filename to AP7131 Independent Access Points running older WiNG 4 firmware and not AP7131 Independent Access Points already running WiNG 5 or other devices in the scope.

The following table highlights the option 60 value supported by the AP7131 Independent Access Points running WiNG 4 firmware:

Option	Description	Format	Example
060	Class Identifier	ASCII or String	MotorolaAP.71xx-V4-1-1 MotorolaAP.71xx-V4-1-2 MotorolaAP.71xx-V4-1-3

Note – The option 60 value supplied by the AP7131 Independent Access Points is version specific. The last 3 octets of the option 60 value will change based on the WiNG 4.1 version running on the device.

Table 1.1.3.3.2-2 – Vendor Class Identifier

Automatic firmware upgrades using DHCP options require the ***Automatic Firmware Upgrade*** parameter to be enabled on the AP7131 Independent Access Points. This parameter is enabled by default, however if this parameter is disabled the AP7131 Independent Access Points will ignore the Motorola DHCP options and will fail to upgrade. If this parameter has been disabled, it can be re-enabled using the CLI or Web-UI:

Command Line Interface:

```
admin> system
admin(system)> fw-update
admin(system.fw-update)> set fw-auto enable
admin(system.fw-update)> save
```

System Configuration → Firmware Update:

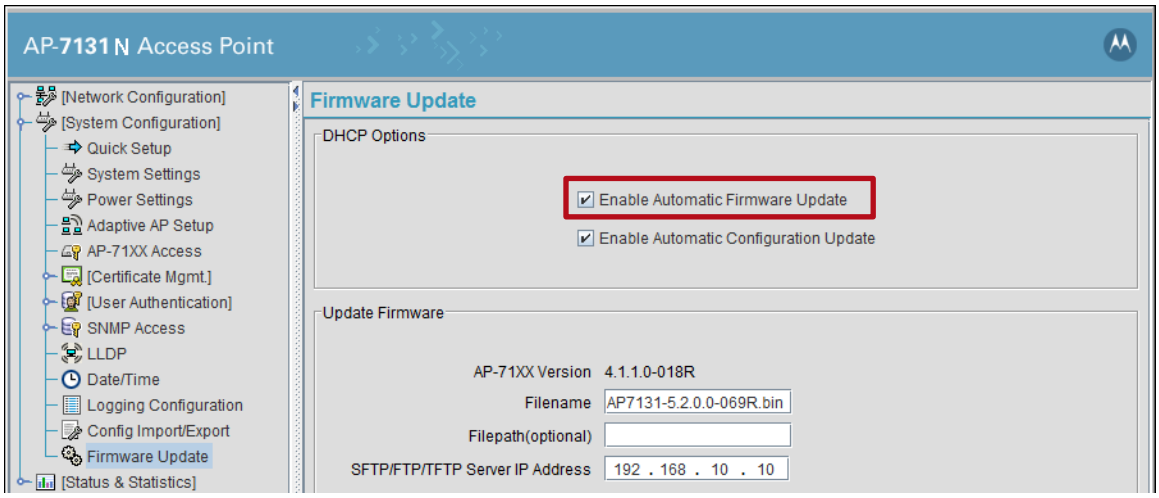


Figure 1.1.3.3.2 – Enabling Automatic Firmware Updates

Note – DHCP server configuration examples are provided in the Appendix.

1.1.3.3.3 Controller Based Upgrades

For deployments where the Wireless Controller is deployed at the same site as the AP7131 Independent Access Points, the migration image upgrade can be initiated from the RFSX000 series Wireless Controller. As the AP7131 Independent Access Points are adopted, the RFSX000 series Wireless Controller running WiNG version 5.2 or higher will initiate the firmware update using the migration image stored in USB or Flash.

Wireless Controller based upgrades are enabled by uploading the AP7131 Independent Access Points migration image onto the RFSX000 series Wireless Controllers USB of Flash storage and enabling the ***Legacy Auto Update*** parameter in the Wireless Controllers profile. The AP7131 Independent Access Points discover the RFSX000 series Wireless Controllers using DHCP options and upon adoption will be pushed the firmware upgrade.

Controller based upgrades can be used to upgrade local AP7131 Independent Access Points using either static or dynamic IP addressing. Upgrades can be performed on all AP7131 Independent Access Points at the same time or on a per building, site or floor basis.

1.1.3.3.3.1 CLI Example

The following procedure outlines how to upload the migration image and enable Legacy Auto Updates for AP7131 Independent Access Points using the CLI:

1 ***Login*** **to the Wireless Controller and copy the migration image to** ***USB*** **or** ***Flash*****:**

```
RFSx000-1# copy tftp://192.168.10.10/Motorola/WiNG5/5.2.1.0-021R/AP7131-5.2.1.0-
021R.bin flash:
```

2 **Verify the migration image has been uploaded:**

```
RFSx000-1# dir all-filesystems

Directory of flash:/.

  drwx              Thu Dec 22 11:24:23 2011   log
  drwx              Fri Dec 31 19:00:08 1999   configs
  drwx              Fri Dec 31 19:00:08 1999   cache
  drwx              Mon Nov 21 11:10:24 2011   crashinfo
  drwx              Mon Sep 19 09:39:59 2011   hotspot
  drwx              Fri Dec 31 19:00:08 1999   floorplans
  -rw-    34345768  Thu Dec 22 11:45:19 2011   AP7131-5.2.1.0-021R.bin
```

3 **Access the Wireless Controllers** ***Profile*** **or** ***Device*** **configuration and enable** ***Legacy Auto Upgrades*** **for the AP7131 Independent Access Points and specify the migration image filename and path:**

```
RFSx000-1(config-profile-tmelabs-rfs4000)# legacy-auto-update ap71xx image
flash:/AP7131-5.2.1.0-021R.bin
```

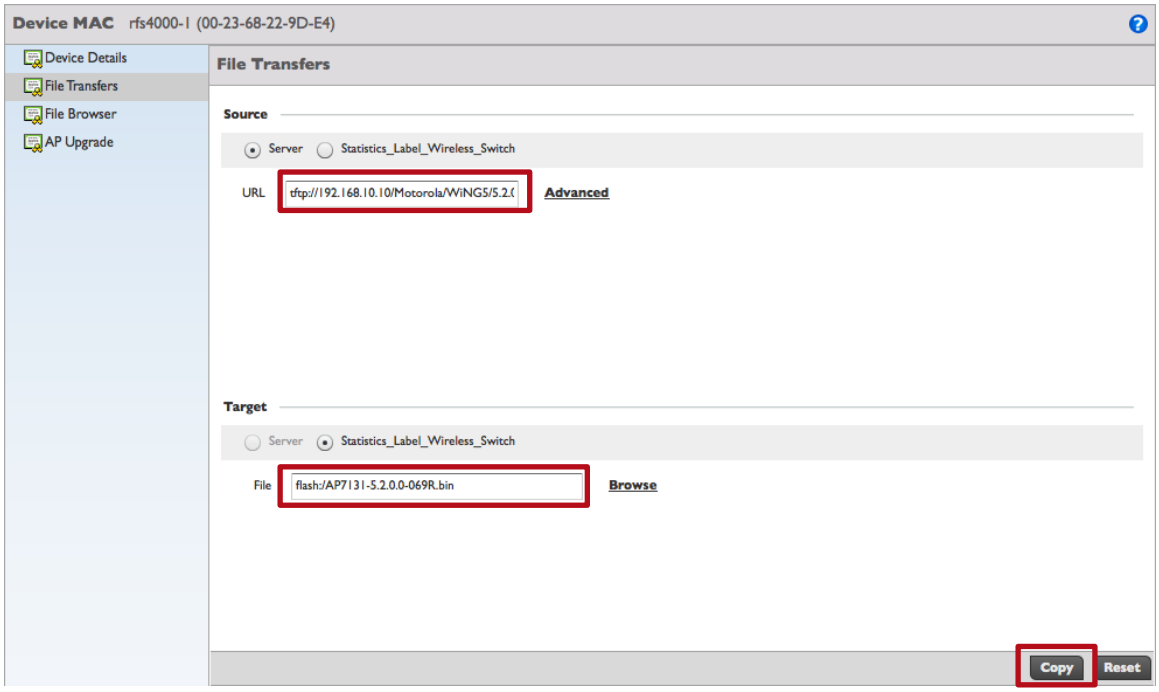
4 ***Commit*** **and** ***Save*** **the changes:**

```
RFSx000-1(config-profile-tmelabs-rfs4000)# commit write
```

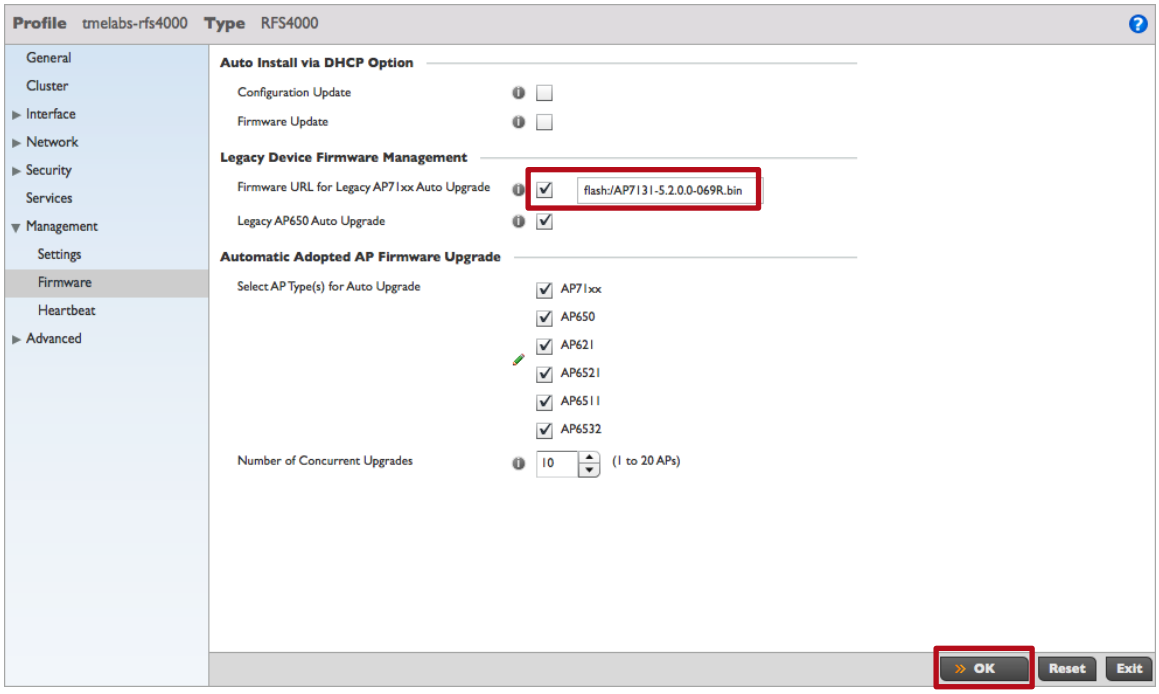
1.1.3.3.3.2 Web-UI Example

The following procedure outlines how to upload the migration image and enable Legacy Auto Updates for AP7131 Independent Access Points using the Web-UI:

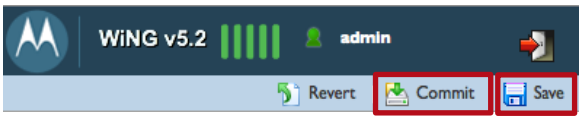
1	**Login to the Wireless Controller then select *Operations → RF-Domain → Integrated-Services-Controller → File Transfers*. In the *Source URL* field enter the source of the migration image (example *tftp://192.168.10.10/Motorola/WiNG5/5.2.1.0-021R/AP7131-5.2.1.0-021R.bin*) and in the *Target URL* field enter the destination of the migration image (example *flash:/AP7131-5.2.1.0-021R.bin*). Click *Copy*:**



2 **Access the Wireless Controllers *Profile* or *Device* configuration and enable *Legacy Auto Upgrades* for the AP7131 Independent Access Points and specify the migration image filename and path (example *flash:/AP7131-5.2.0.0-069R.bin*). Click *OK*:**



3 ***Commit* and *Save* the changes:**



Note – Upgrades from an RFSX000 Wireless Controller are staggered so that the performance of the Wireless Controller is not impacted. Wireless Controller based upgrades are only recommended when the Wireless Controller is deployed at the same site as the AP7131 Independent Access Points.

1.2 Access Point Adoption

In WiNG 4 AP300 and AP650 Dependent Access Points can be adopted and managed by a local Wireless Controller at layer 2 or layer 3 while AP7131 Independent Access Points can only be adopted at layer 3. In WiNG 5.2 or higher both Dependent and Independent Access Points can all be adopted at layer 2 or layer 3.

When a Wireless Controller is deployed on the same VLAN as a Dependent or Independent Access Point, the Access Point will automatically discover and adopt with a Wireless Controller over its Native VLAN. No additional configuration is required.

When an intermediate Layer 3 device such as a router or layer 3 switch is deployed between the Wireless Controllers and Access Points, the Access Points must be statically or dynamically assigned an IPv4 address, subnet mask and default gateway in addition to be provided with the IP address or hostname of the Wireless Controllers.

1.2.1 DHCP Wireless Controller Discovery

To support plug-n-play Access Point deployments in a layer 3 environment, by default Dependent and Independent Access Points support a DHCP client on their Native VLAN 1 and expect a DHCP server to supply an IPv4 address, subnet mask, default gateway and Motorola DHCP options to tell them how to discover and reach the Wireless Controllers.

The Motorola DHCP options required for Dependent and Independent Access Points differs by WiNG version, Access Point model and deployment.

1.2.1.1 Motorola DHCP Option 189 & 192

AP300 / AP650 Dependent and AP7131 Independent Access Points running WiNG 4 firmware require Motorola DHCP option 189 to supply one or more Wireless Controller IP addresses. The AP7131 Dependent Access Points also require Motorola DHCP option 192 to determine how to discover the Wireless Controllers. Both DHCP option 189 and 192 must be supplied to the AP7131 Independent Access Points for automatic Wireless Controller discover to function.

The following table highlights the Motorola DHCP options required to support AP300 / AP650 Dependent and AP7131 Independent Access Points running WiNG 4 firmware:

Option	Format	Syntax	Notes
189	ASCII / String	<controller-ip> <controller-ip> <controller-ip>,<controller-ip> <controller-ip>; <controller-ip>	AP300 Dependent Access Points AP650 Dependent Access Points AP7131 Independent Access Points
192	ASCII / String	0 = Auto Discovery Disabled 1 = Auto Discovery over IP 2 = Auto Discovery over IPsec	AP7131 Independent Access Points Only

Table 1.2.1.1 WiNG 4.x Motorola DHCP Options

1.2.1.2 Motorola DHCP Option 191

AP650 Dependent and AP7131 Independent Access Points running WiNG 5.2 or higher firmware support Motorola DHCP option 191 to supply one or more Wireless Controller IP addresses or hostnames in addition to the MiNT link level, MiNT UDP port and MiNT timers.

The following table highlights the Motorola DHCP options required to support AP650 Dependent and AP7131 Independent Access Points running WiNG 5.2 or higher firmware for local Wireless Controller based deployments:

Option	Format	Examples
191	ASCII / String	pool1=<controller-ip>,<controller-ip> pool1=<controller-hostname>,<controller-hostname> pool1=<controller-ip>,<controller-hostname> pool1=<controller-ip>,<controller-ip>;udp-port=<port> pool1=<controller-ip>,<controller-ip>; hello-interval=20;adjacency-hold-time=60

Table 1.2.1.2-1 WiNG 5.x Motorola DHCP Options (Local Controller)

The following table highlights the Motorola DHCP options required to support AP7131 Independent Access Points running WiNG 5.2 or higher firmware for centralized Wireless Controller based deployments:

Option	Format	Examples
191	ASCII / String	pool1=<controller-ip>,<controller-ip>;level=2 pool1=<controller-hostname>,<controller-hostname>;level=2 pool1=<controller-ip>,<controller-hostname>;level=2 pool1=<controller-ip>,<controller-ip>;level=2;udp-port=<port> pool1=<controller-ip>,<controller-ip>;level=2; hello-interval=20;adjacency-hold-time=60

Table 1.2.1.2-2 WiNG 5.x Motorola DHCP Options (Centralized Controller)

Note – It is recommended that the ***hello-interval*** value be set to 1/3rd the ***adjacency-hold-time*** value. For example if the ***adjacency-hold-time*** value is set to ***60*** seconds, the ***hello-interval*** must be set to ***20*** seconds.

Note – Any ***hello-interval*** and ***adjacency-hold-time*** values assigned from DHCP option 191 will supersede any values assigned to a profile or directly to a device as override.

1.2.1.3 DHCP Option 60 Vendor Class

AP650 Dependent and AP7131 Independent Access Points support the standard DHCP option 60 vendor class option which is supplied to the DHCP server with the DHCP discover and ACK messages. The DHCP option 60 vendor class value supplied by the AP650 Dependent and AP7131 Independent Access Points can be filtered by the DHCP server to supply specific DHCP options and values such as Wireless Controller IP addresses / hostnames used for adoption or TFTP server address and firmware image filenames for firmware upgrades.

The DHCP option 60 vendor class is not supported on AP300 / AP650 Dependent Access Points running WiNG 4 but is supported by the AP650 Dependent Access Points once they have been upgraded to WiNG 5.2 or higher firmware. The DHCP option 60 vendor class is supported by the AP7131 Independent Access Points running both WiNG 4 and WiNG 5.2 or higher firmware but the values supplied differ by release.

The following table highlights the standard DHCP option 60 vendor class values supplied by AP300 Dependent Access Points running WiNG 4 or WiNG 5.2 or higher firmware:

WiNG Version	Vendor Class Identifier
4.x (Any Version)	Not Supported
5.x (Any Version)	Not Supported

Table 1.2.1.3-1 – AP300 DHCP Option 60 Vendor Class Values

The following table highlights the standard DHCP option 60 vendor class values supplied by AP650 Dependent Access Points running WiNG 4 or WiNG 5.2 or higher firmware:

WiNG Version	Vendor Class Identifier
4.x (Any Version)	Not Supported
5.x (Any Version)	MotorolaAP.AP650

Table 1.2.1.3-2 – AP650 DHCP Option 60 Vendor Class Values

The following table highlights the standard DHCP option 60 vendor class values supplied by AP7131 Independent Access Points running WiNG 4 or WiNG 5.2 or higher firmware:

WiNG Version	Vendor Class Identifier
4.1.1.x	MotorolaAP.71xx-V4-1-1
4.1.2.x	MotorolaAP.71xx-V4-1-2
4.1.3.x	MotorolaAP.71xx-V4-1-3
5.x (Any Version)	MotorolaAP.AP7131

Table 1.2.1.3-3 – AP7131 DHCP Option 60 Vendor Class Values

1.2.2 DNS Wireless Controller Discovery

In WiNG 4 AP300 / AP650 Dependent Access Points can discover the Wireless Controllers using DNS name resolution. If DHCP options are not provided by the DHCP server, the AP300 / AP650 Dependent Access Points will attempt to discover the Wireless Controllers by resolving the hostname ***SYMBOL-WISPE-ADDRESS***.

In WiNG 5 all Dependent and Independent Access Points support DNS based discovery and can discover the Wireless Controllers by resolving the hostname ***motorola-wl***c. One major change in WiNG 5 is that the AP650 Dependent and AP7131 Independent Access Points support the ability to resolve the hostname at each DNS domain level (highest to lowest). For example if a Wireless Controller cannot be reached at the level east.us.example.com, the next level us.example.com is checked. This allows the hostname to be assigned to any level within the DNS domain tree.

DNS discovery of multiple Wireless Controllers in WiNG 4 and WiNG 5 is achieved by defining multiple DNS A records for the ***SYMBOL-WISPE-ADDRESS*** or,***motorola-wlc*** hostnames. When multiple A records have been defined, the DNS server will respond to a query with multiple host IP addresses which the AP650 Dependent or AP7131 Independent Access Points will use to discover the Wireless Controllers.

The following table highlights the DNS A record hostnames which are required in WiNG 4 and WiNG 5 to support DNS based Wireless Controller discovery:

WiNG Version	DNS Hostnames
4.x (AP300/AP650)	SYMBOL-WISPE-ADDRESS.example.com
5.x (AP650/AP7131)	motorola-wlc.east.us.example.com motorola-wlc.us.example.com motorola-wlc.com

Table 1.2.2 – DNS Hostnames

For WiNG 5 centralized Wireless Controller deployments with AP7131 Independent Access Points, it's important to note that DNS based Wireless Controller discovery will only create IP based level 1 MiNT links from the AP7131 Independent Access Points to the centralized Wireless Controllers in the data center / NOC. DNS based Wireless Controller discovery cannot be utilized to create IP based level 2 MiNT links. If DNS based Wireless Controller discovery is required for the deployment, the AP7131 Independent Access Point profiles must be configured with static level 2 controller-host entries.

The remote AP7131 Independent Access Points will discover centralized the Wireless Controllers using DNS name resolution and will create a level 1 MiNT link to the centralized Wireless Controllers in the data center / NOC. Once the AP7131 Independent Access Points receive their Profile from the centralized Wireless Controllers, they will migrate to a level 2 MiNT link using the static controller-host entries defined in the Access Point Profile.

Note – For centralized Wireless Controller deployments, DNS discovery will only form IP based level 1 MiNT links from the Access Points to the centralized Wireless Controllers. For level 2 MiNT links to be established, static Wireless Controller IP addresses or hostnames must be added to the Access Point Profiles.

1.2.3 Static Wireless Controller Discovery

For layer 3 deployments in WiNG 5 where DHCP servers are not available, DHCP options cannot be provided or DNS is not available, administrators can optionally assign static Wireless Controller IP addresses or hostnames directly to the AP650 Independent or AP7131 Dependent Access Points.

Static Wireless Controller IP addresses and hostnames can be assigned to AP650 Dependent and AP7131 Independent Access Points running WiNG 5.2 or higher using Profiles or overrides. Administrators can specify the primary and secondary Wireless Controller IP addresses or hostnames in addition to the MiNT link level.

Static Controller IP addresses assigned to AP7131 Independent Access Points in WiNG 4 are migrated during the WiNG 5 upgrade. Any static Wireless Controller IP addresses are added to AP7131 Independent Access Points devices configuration as overrides. Note however that if the auto-learn-staging-config parameter is disabled on Wireless Controllers no static configuration is maintained.

The following table provides the example syntax for adding static Wireless Controller IP addresses or hostnames to a Profile or device for local and centralized Wireless Controller deployments:

Static Wireless Controller Example (Local Controller)
controller-host <ip-address>
controller-host <hostname>
Static Wireless Controller Example (Centralized Controller)
controller-host <ip-address> level 2
controller-host <hostname> level 2

Table 1.2.3 – Static Wireless Controller Discovery

Note – For hostnames to be supported, the Access Points must be configured with one or more DNS domain name servers in addition to a domain name.

2. Appendix

2.1 DHCP Server Examples

2.1.1 Cisco IOS Examples

2.1.1.1 AP300 / AP650 / AP7131 Local Controller Deployments

The following Cisco IOS DHCP server example can be followed to support mixed AP300 / AP650 Dependent and AP7131 Independent Access Points for local Wireless Controller deployments:

1. Motorola DHCP option 186 is defined as a scope option to provide the AP7131 Independent Access Points running WiNG 4 with the migration image filename.
2. Motorola DHCP option 187 is defined as a scope option to provide AP7131 Independent Access Points running WiNG 4 with the TFTP server address where the migration image is hosted.
3. Motorola DHCP option 189 is defined as a scope option to provide AP300 / AP 650 Independent and AP7131 Dependent Access Points running WiNG 4 or WiNG 5 with the Wireless Controller IP addresses.
4. Motorola DHCP option 192 is defined as a scope option to determine how AP7131 Dependent Access Points running WiNG 4 discover the Wireless Controllers.

Example:

```
!
ip dhcp excluded-address 192.168.11.1 192.168.11.99
!
ip dhcp pool Access-Point-VLAN
 import all
 network 192.168.11.0 255.255.255.0
 domain-name example.com
 dns-server 192.168.10.6
 default-router 192.168.11.1
 option 186 ascii 192.168.11.10
 option 187 ascii AP7131-5.2.1.0-021R.bin
 option 189 ascii 192.168.20.20,192.168.20.21
 option 192 ascii 1
!
```

2.1.1.2 AP7131 Centralized Controller Deployments

The following Cisco IOS DHCP server example can be followed to support AP7131 Independent Access Points for centralized Wireless Controller deployments:

1. Motorola DHCP option 186 is defined as a scope option to provide the AP7131 Independent Access Points running WiNG 4 with the migration image filename.
2. Motorola DHCP option 187 is defined as a scope option to provide AP7131 Independent Access Points running WiNG 4 with the TFTP server address where the migration image is hosted.
3. Motorola DHCP option 189 is defined as a scope option to provide the AP7131 Dependent Access Points running WiNG 4 with the Wireless Controller IP addresses.
4. Motorola DHCP option 191 is defined as a scope option to provide AP7131 Dependent Access Points running WiNG 5 with the Wireless Controller IP addresses and MiNT link level.
5. Motorola DHCP option 192 is defined as a scope option to determine how AP7131 Dependent Access Points running WiNG 4 discover the Wireless Controllers.

Example:

```
!
ip dhcp excluded-address 192.168.11.1 192.168.11.99
!
ip dhcp pool Access-Point-VLAN
 import all
 network 192.168.11.0 255.255.255.0
 domain-name example.com
 dns-server 192.168.10.6
 default-router 192.168.11.1
 option 186 ascii 192.168.11.10
 option 187 ascii AP7131-5.2.1.0-021R.bin
 option 189 ascii 192.168.20.20,192.168.20.21
 option 191 ascii pool1=192.168.20.20,192.168.20.21;level=2
 option 192 ascii 1
!
```

2.1.2 Linux ISC Examples

2.1.2.1 AP300 / AP650 / AP7131 Local Controller Deployments

The following Linux ISC DHCP server example can be followed to support mixed AP300 / AP650 Dependent and AP7131 Independent Access Points for local Wireless Controller deployments:

1. Motorola DHCP option 186 is defined as a scope option to provide the AP7131 Independent Access Points running WiNG 4 with the migration image filename.
2. Motorola DHCP option 187 is defined as a scope option to provide AP7131 Independent Access Points running WiNG 4 with the TFTP server address where the migration image is hosted.
3. Motorola DHCP option 189 is defined as a scope option to provide AP7131 Dependent Access Points running WiNG 4 or WiNG 5 with the Wireless Controller IP addresses.
4. Motorola DHCP option 192 is defined as a scope option to determine how AP7131 Dependent Access Points running WiNG 4 discover the Wireless Controllers.

Example:

```
# DHCP Options
ddns-update-style none;
option domain-name "example.com";
option domain-name-servers 192.168.10.6;
option tftp-server code 186 = string;
option firmware-image code 187 = string;
option legacy-controller-ip code 189 = string;
option controller-discovery code 192 = string;
```

```
# Access-Point-VLAN Scope
subnet 192.168.11.0 netmask 255.255.255.0 {
        authoritative;
        range 192.168.11.100 192.168.11.254;
        option routers 192.168.11.1;
        option tftp-server-ip “192.168.11.10”;
        option firmware-image-filename “AP7131-5.2.1.0-021R.bin”;
        option legacy-controller-ip “192.168.20.20,192.168.20.21”;
        option controller-discovery “1”;
        }
```

2.1.2.2 AP7131 Local Controller Deployments

The following Linux ISC DHCP server example can be followed to support AP7131 Independent Access Points for local Wireless Controller deployments. Note that this example leverages the vendor class identifier supported by the AP7131 Independent Access Points and will supply specific options to the Access Points based on their WiNG version:

1. Motorola DHCP option 186 is defined as a vendor class option to provide the AP7131 Independent Access Points running WiNG 4 with the migration image filename.
2. Motorola DHCP option 187 is defined as a vendor class option to provide AP7131 Independent Access Points running WiNG 4 with the TFTP server address where the migration image is hosted.
3. Motorola DHCP option 189 is defined as a vendor class option to provide AP7131 Dependent Access Points running WiNG 4 or WiNG 5 with the Wireless Controller IP addresses.
4. Motorola DHCP option 192 is defined as a vendor class option to determine how AP7131 Dependent Access Points running WiNG 4 discover the Wireless Controllers.

Example:

```
# DHCP Options
ddns-update-style none;
option domain-name "example.com";
option domain-name-servers 192.168.10.6;
option tftp-server code 186 = string;
option firmware-image code 187 = string;
option legacy-controller-ip code 189 = string;
option controller-discovery code 192 = string;
```

```
# Vendor Class for WiNG 4.1.1.x Motorola AP7131 Independent Access Points
class "MotorolaAP.71xx-V4-1-1" {
  match if substring (option vendor-class-identifier, 0, 22) = "MotorolaAP.71xx-V4-1-1";
    option tftp-server-ip "192.168.11.10";
    option firmware-image-filename "AP7131-5.2.1.0-021R.bin";
    option legacy-controller-ip “192.168.20.20,192.168.20.21”
    option controller-discovery “1”;
    option vendor-class-identifier "MotorolaAP.71xx-V4-1-1";
}
```

```
# Vendor Class for WiNG 5 Motorola AP7131 Independent Access Points
class "MotorolaAP.AP7131" {
 match if substring (option vendor-class-identifier, 0, 17) = "MotorolaAP.AP7131";
   option controller-ip-address "pool1=192.168.20.20;192.168.20.21";
   option vendor-class-identifier "MotorolaAP.AP7131";
}
```

```
# Access-Point-VLAN Scope
subnet 192.168.11.0 netmask 255.255.255.0 {
        authoritative;
        range 192.168.11.100 192.168.11.254;
```

```
        option routers 192.168.11.1;
        }
```

2.1.2.3 AP7131 Centralized Controllers Deployments

The following Linux ISC DHCP server example can be followed to support AP7131 Independent Access Points for local Wireless Controller deployments. Note that this example leverages the vendor class identifier supported by the AP7131 Independent Access Points and will supply specific options to the Access Points based on their WiNG version:

1. Motorola DHCP option 186 is defined as a vendor option to provide the AP7131 Independent Access Points running WiNG 4 with the migration image filename.
2. Motorola DHCP option 187 is defined as a vendor class option to provide AP7131 Independent Access Points running WiNG 4 with the TFTP server address where the migration image is hosted.
3. Motorola DHCP option 189 is defined as a vendor class option to provide AP7131 Dependent Access Points running WiNG 4 with the Wireless Controller IP addresses.
4. Motorola DHCP option 191 is defined as a vendor class option to provide AP7131 Dependent Access Points running WiNG 5 with the Wireless Controller IP addresses and MiNT link level.
5. Motorola DHCP option 192 is defined as a vendor class option to determine how AP7131 Dependent Access Points running WiNG 4 discover the Wireless Controllers.

Example:

```
# DHCP Options
ddns-update-style none;
option domain-name "example.com";
option domain-name-servers 192.168.10.6;
option tftp-server code 186 = string;
option firmware-image code 187 = string;
option legacy-controller-ip code 189 = string;
option controller-discovery code 192 = string;
```

```
# Vendor Class for WiNG 4.1.1.x Motorola AP7131 Independent Access Point
class "MotorolaAP.71xx-V4-1-1" {
  match if substring (option vendor-class-identifier, 0, 22) = "MotorolaAP.71xx-V4-1-1";
    option tftp-server-ip "192.168.11.10";
    option firmware-image-filename "AP7131-5.2.1.0-021R.bin";
    option legacy-controller-ip “192.168.20.20,192.168.20.21”;
    option controller-discovery “1”;
    option vendor-class-identifier " MotorolaAP.71xx-V4-1-1";
}
```

```
# Vendor Class for Motorola AP7131 Access Points
class "MotorolaAP.AP7131" {
 match if substring (option vendor-class-identifier, 0, 17) = "MotorolaAP.AP7131";
   option controller-ip-address "pool1=192.168.20.20,192.168.20.21;level=2";
   option vendor-class-identifier "MotorolaAP.AP7131";
}
```

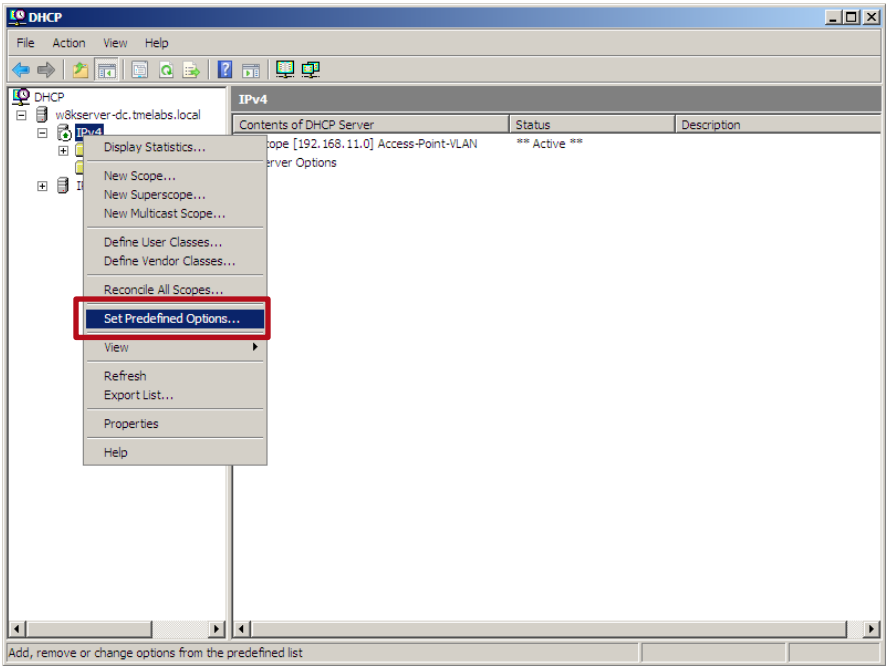
```
# Access-Point-VLAN Scope
subnet 192.168.11.0 netmask 255.255.255.0 {
        authoritative;
        range 192.168.11.100 192.168.11.254;
        option routers 192.168.11.1;
        }
```

2.1.3 Microsoft DHCP Examples

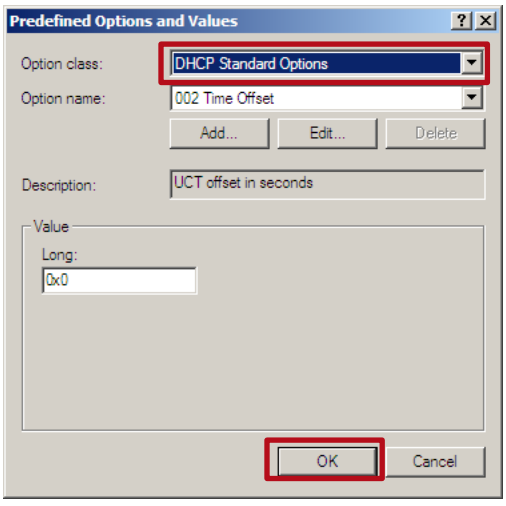
2.1.3.1 Defining and Enabling Scope Options

The following example outlines how to define Motorola DHCP options on a Microsoft DHCP server which can be assigned directly to a DHCP scope:

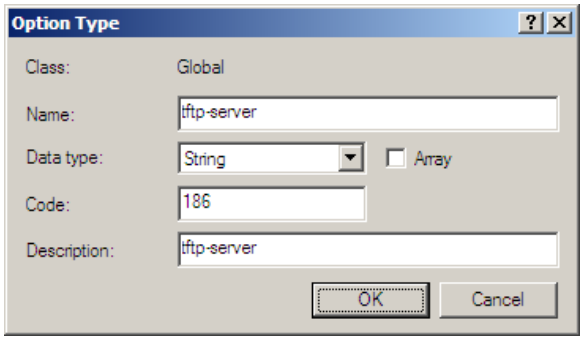
1 Using the DHCP snap-in, right-click on *IPv4* then select *Set Predefined Options*:



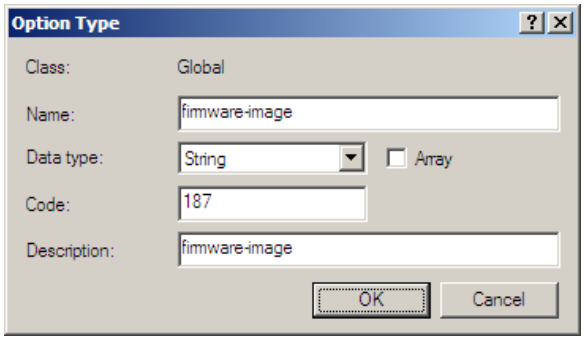
2 Set the *Option class* to *DHCP Standard Options* then click *Add*:



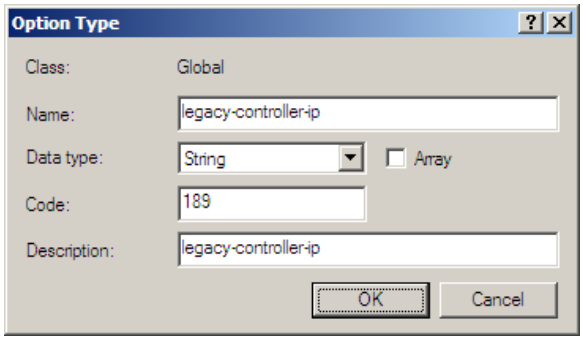
3 Define the following *Option Types*:



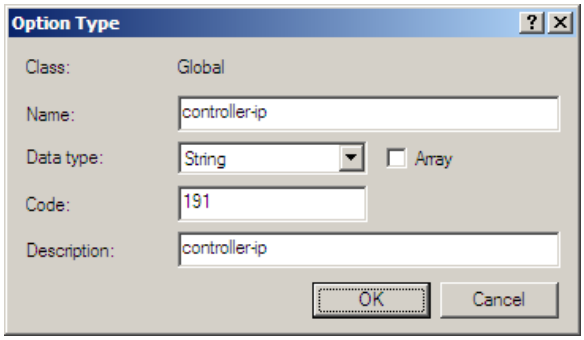
Option 186 – TFTP Server IP Address



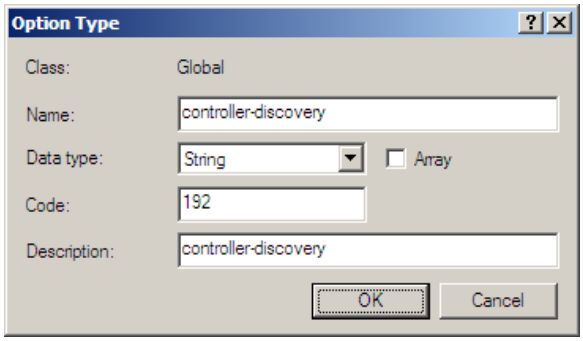
Option 187 – Firmware Image Filename



Option 189 – Legacy Controller IP Address

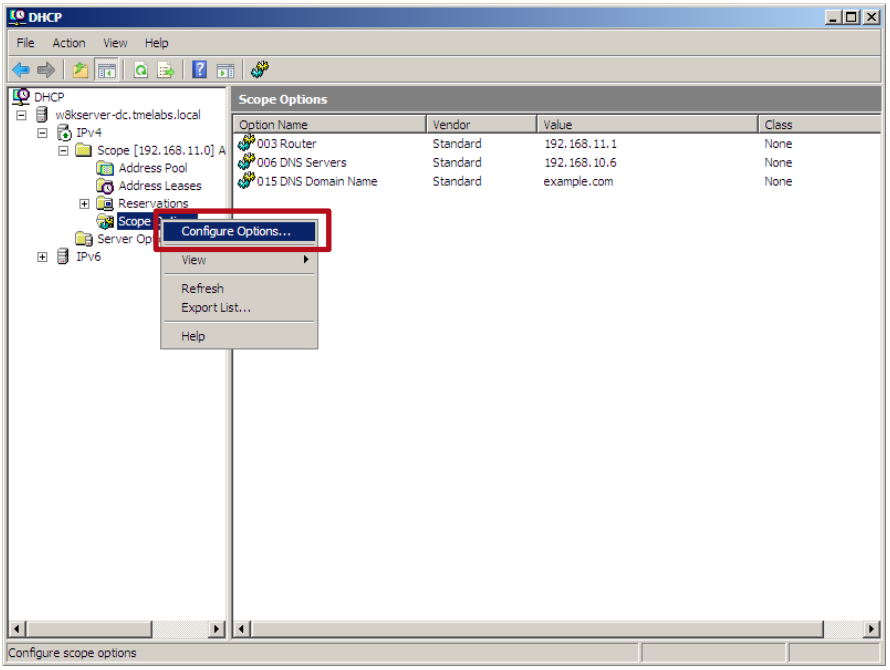


Option 191 – Controller IP Address

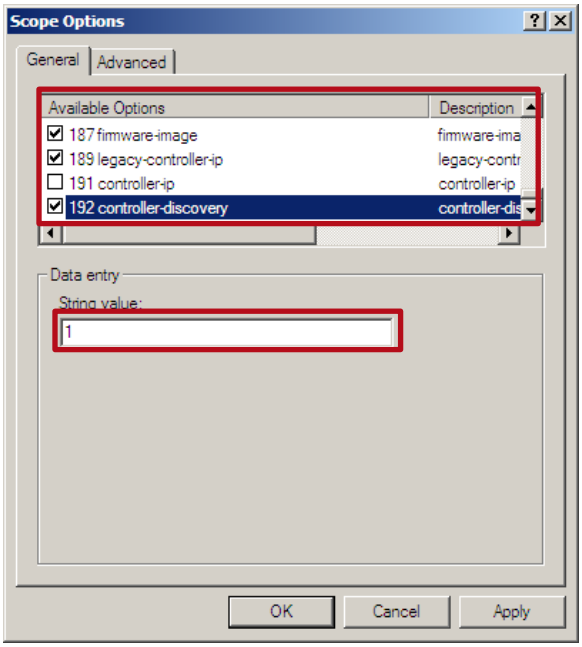


Option 192 – Controller Discovery

4 **Using the DHCP snap-in, expand the IPv4 scope then right-click on *Scope Options* and select *Configure Options*:**



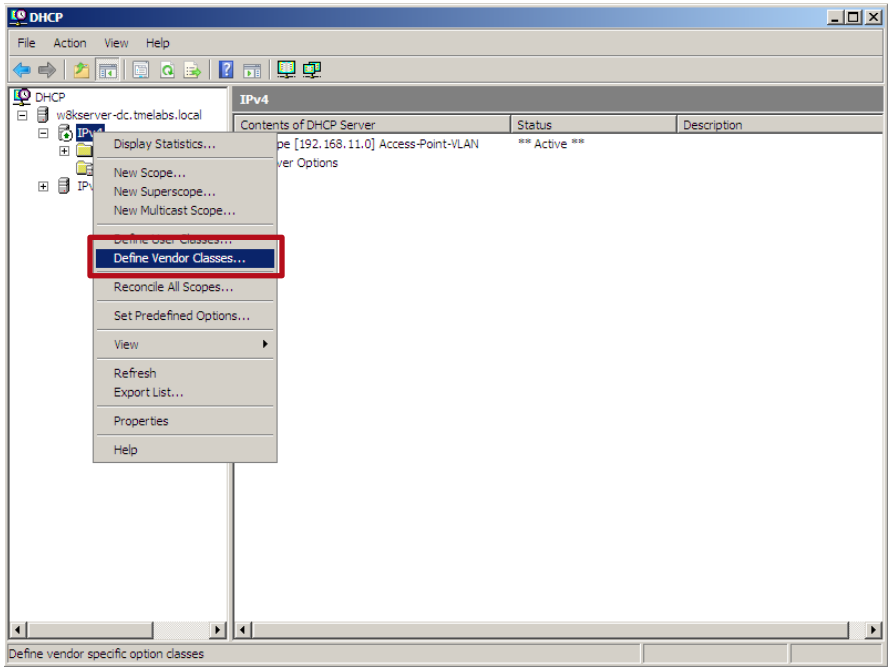
5 **In the *Available Options* list select desired Motorola options then enter the required values:**



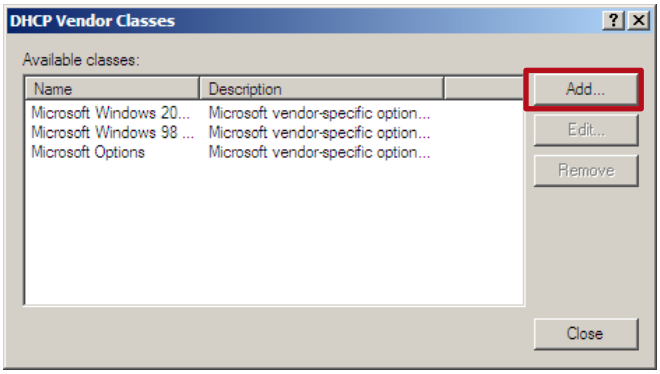
2.1.3.2 Defining and Enabling Vendor Class Options

The following example outlines how to define Motorola DHCP options on a Microsoft DHCP server which can be assigned to a DHCP scope as a vendor class option:

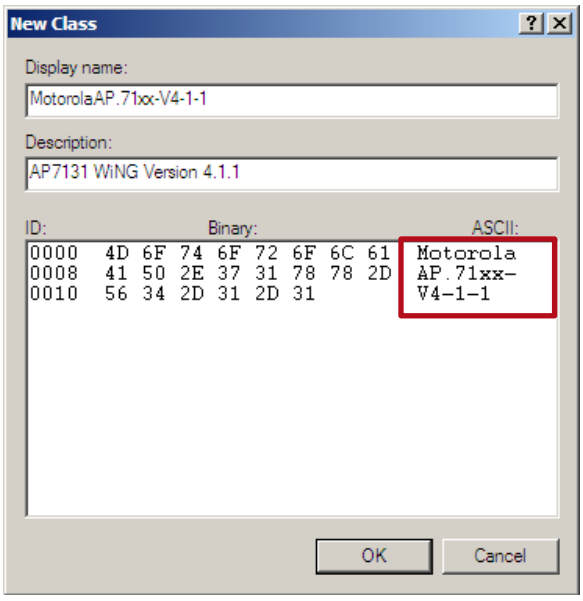
1 **Using the DHCP snap-in, right-click on *IPv4* then select *Define Vendor Classes*:**



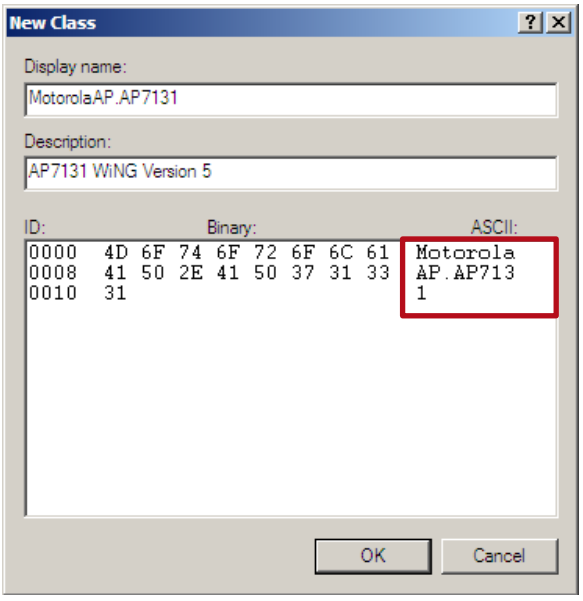
2 **Click *Add*:**



3 **Define a *Display name* and *Description*. In the *ASCII* field enter the require vendor class identifier for the AP7131 Independent Access Point. Note that the WiNG 4 vendor class is version dependent:**

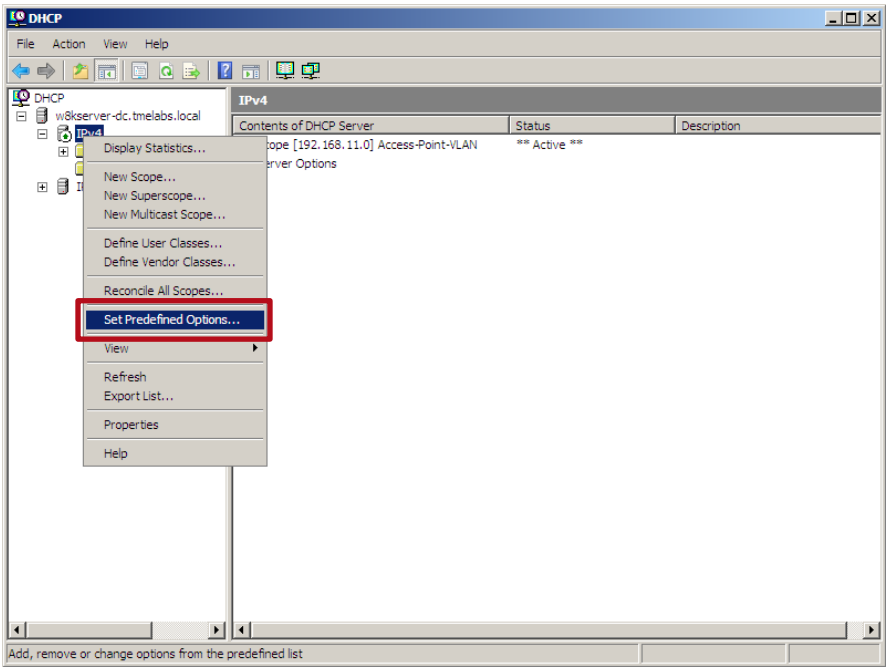


AP7131 WiNG 4.1.1 Vendor Class Example

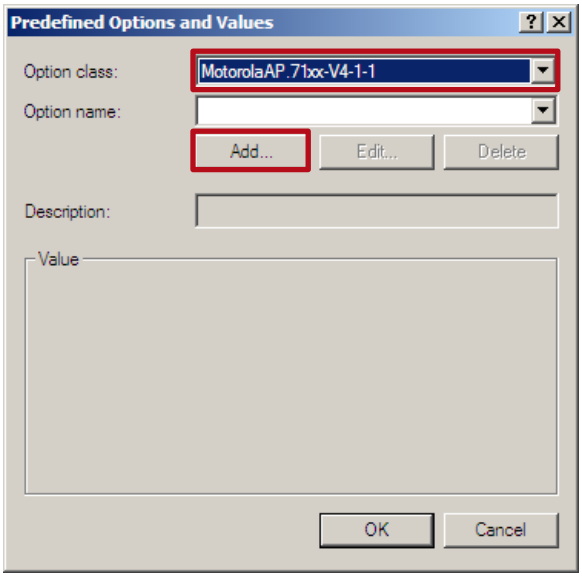


AP7131 WiNG 5 Vendor Class Example

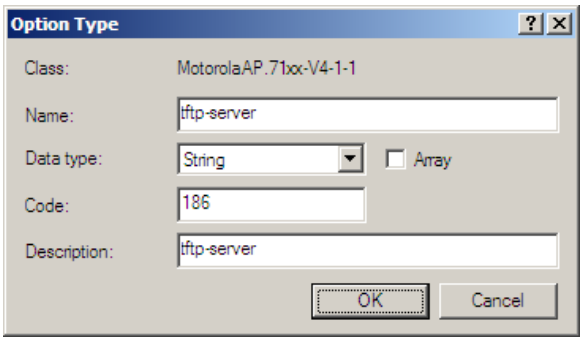
4 **Right-click on *IPv4* then select *Set Predefined Options*:**



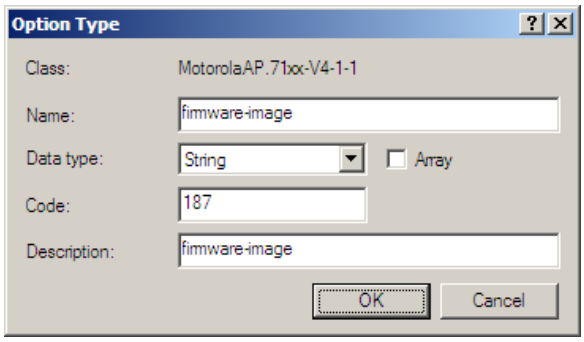
5 In the *Option class* field select the WiNG 4 vendor class then click *Add*:



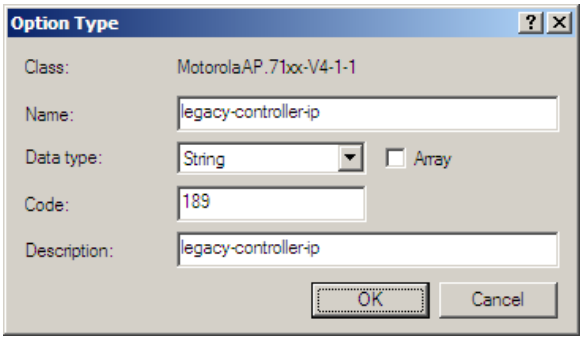
6 Define the following WiNG 4 *Option Types*:



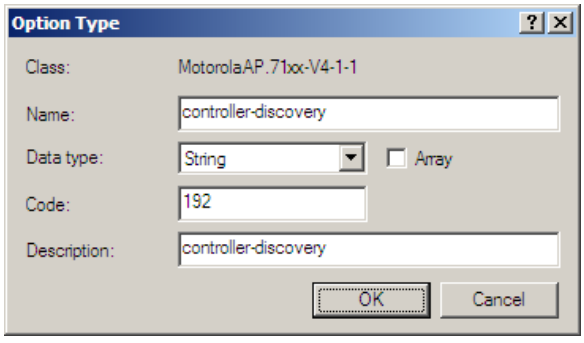
Option 186 – TFTP Server IP Address



Option 187 – Firmware Image Filename

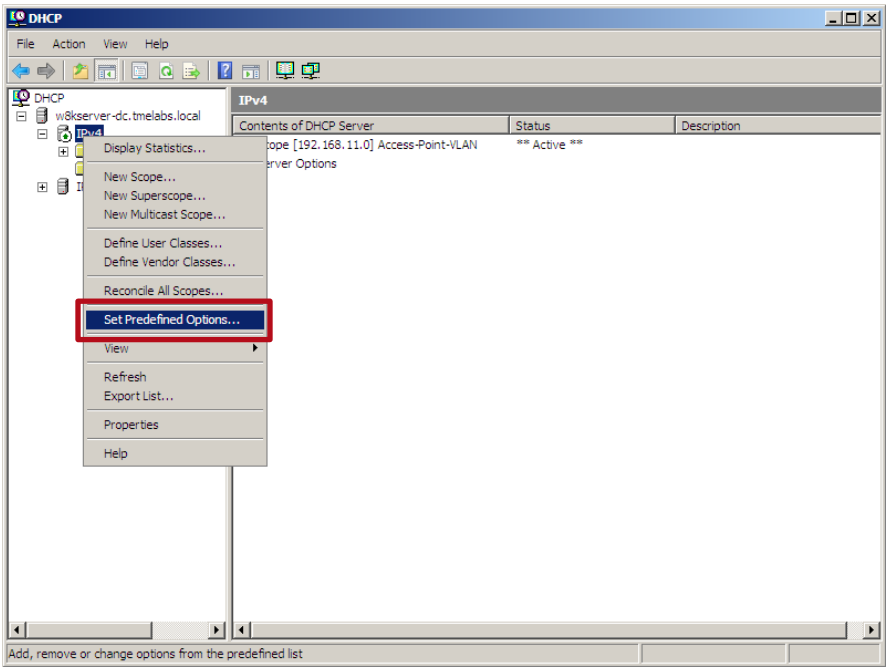


Option 189 – Legacy Controller IP Address

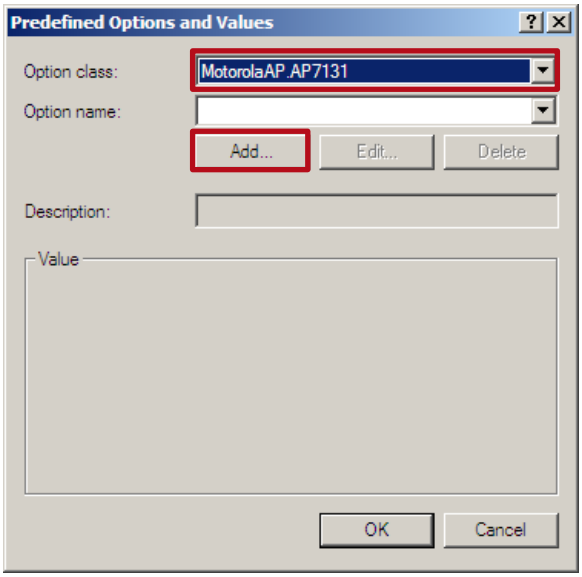


Option 192 – Controller Discovery

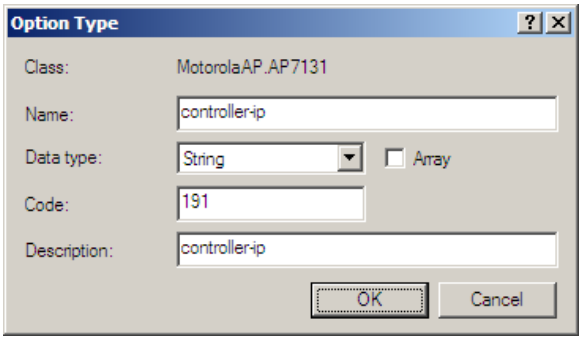
7 **Right-click on *IPv4* then select *Set Predefined Options*:**



8 **In the *Option class* field select the WiNG 5 vendor class then click *Add*:**

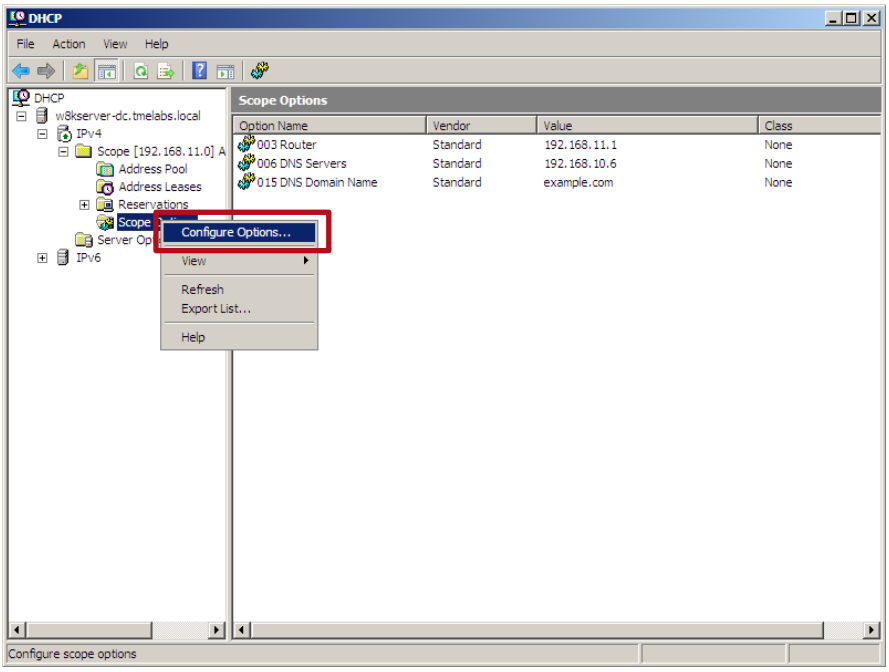


9 **Define the following WiNG 5 *Option Type*:**

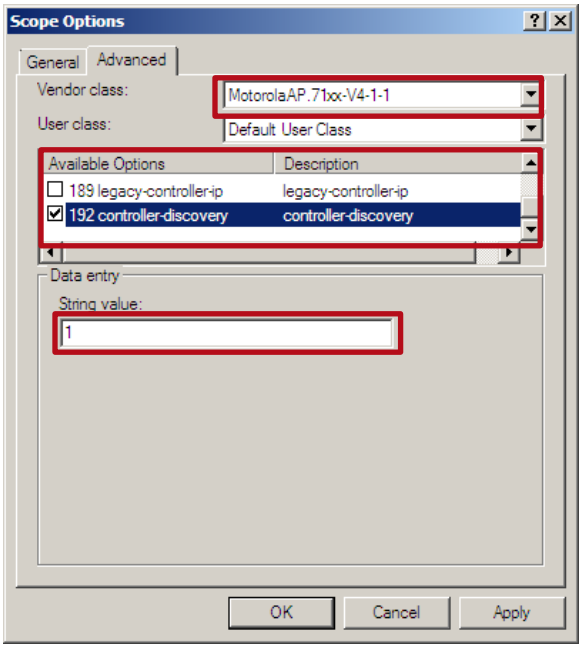


Option 191 – Controller IP Address

10 **Using the DHCP snap-in, expand the IPv4 scope then right-click on *Scope Options* and select *Configure Options*:**



11	**Select *Advanced* then in the *Vendor class* pull down menu select the WiNG 4 or WiNG 5 vendor class. In the *Available Options* list select desired Motorola options then enter the required values:**

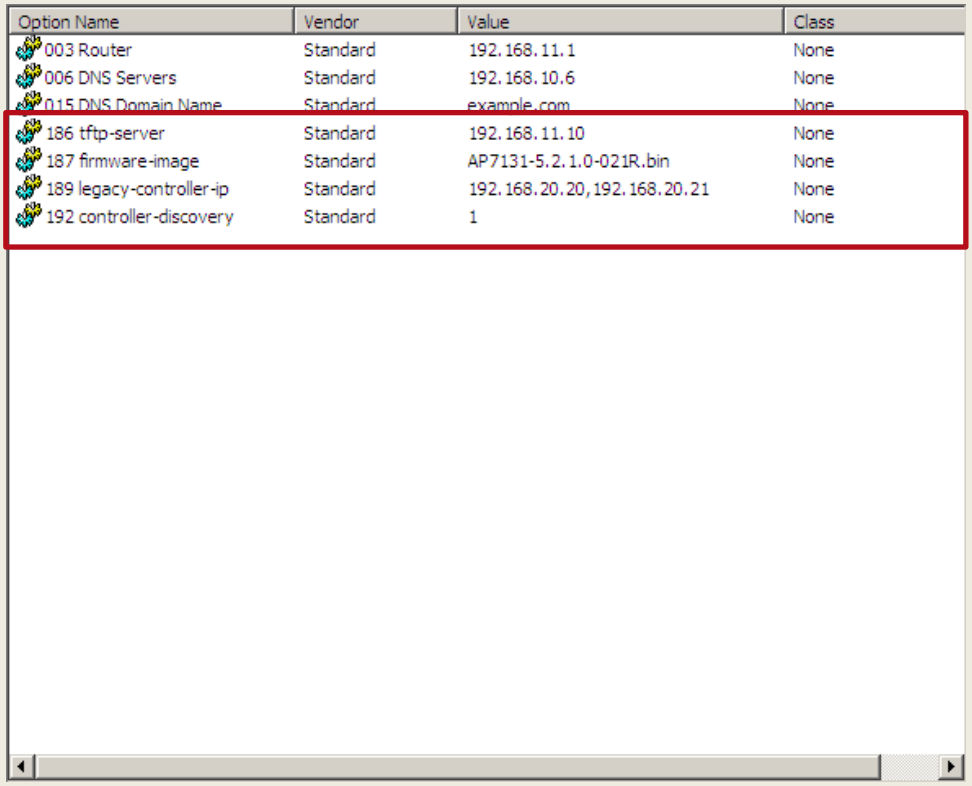


2.1.3.3 AP300 / AP650 / AP7131 Local Controller Deployments

The following Microsoft DHCP scope example can be followed to support mixed AP300 / AP650 Dependent and AP7131 Independent Access Points for local Wireless Controller deployments:

1. Motorola DHCP option 186 is defined as a scope option to provide the AP7131 Independent Access Points running WiNG 4 with the migration image filename.
2. Motorola DHCP option 187 is defined as a scope option to provide AP7131 Independent Access Points running WiNG 4 with the TFTP server address where the migration image is hosted.
3. Motorola DHCP option 189 is defined as a scope option to provide AP7131 Dependent Access Points running WiNG 4 or WiNG 5 with the Wireless Controller IP addresses.
4. Motorola DHCP option 192 is defined as a scope option to determine how AP7131 Dependent Access Points running WiNG 4 discover the Wireless Controllers.

Example:

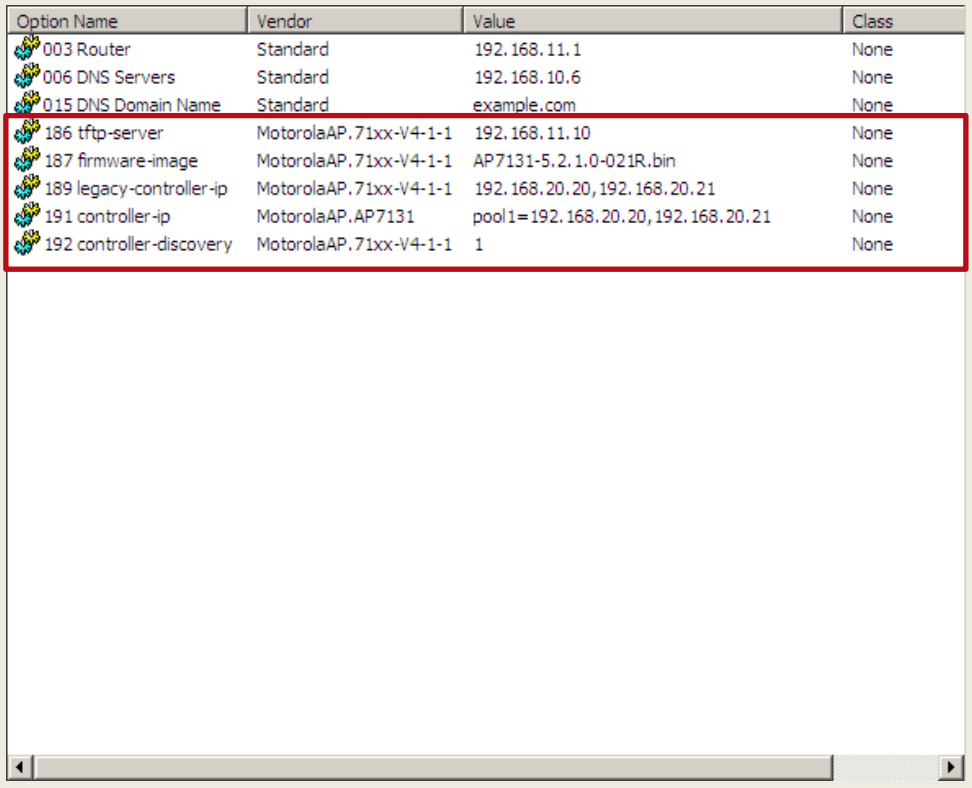


2.1.3.4 AP7131 Local Controller Deployments

The following Microsoft DHCP scope example can be followed to support AP7131 Independent Access Points for local Wireless Controller deployments. Note that this example leverages the vendor class identifier supported by the AP7131 Independent Access Points and will supply specific options to the Access Points based on their WiNG version:

1. Motorola DHCP option 186 is defined as a vendor class option to provide the AP7131 Independent Access Points running WiNG 4 with the migration image filename.
2. Motorola DHCP option 187 is defined as a vendor class option to provide AP7131 Independent Access Points running WiNG 4 with the TFTP server address where the migration image is hosted.
3. Motorola DHCP option 189 is defined as a vendor class option to provide AP7131 Dependent Access Points running WiNG 4 or WiNG 5 with the Wireless Controller IP addresses.
4. Motorola DHCP option 192 is defined as a vendor class option to determine how AP7131 Dependent Access Points running WiNG 4 discover the Wireless Controllers.

Example:



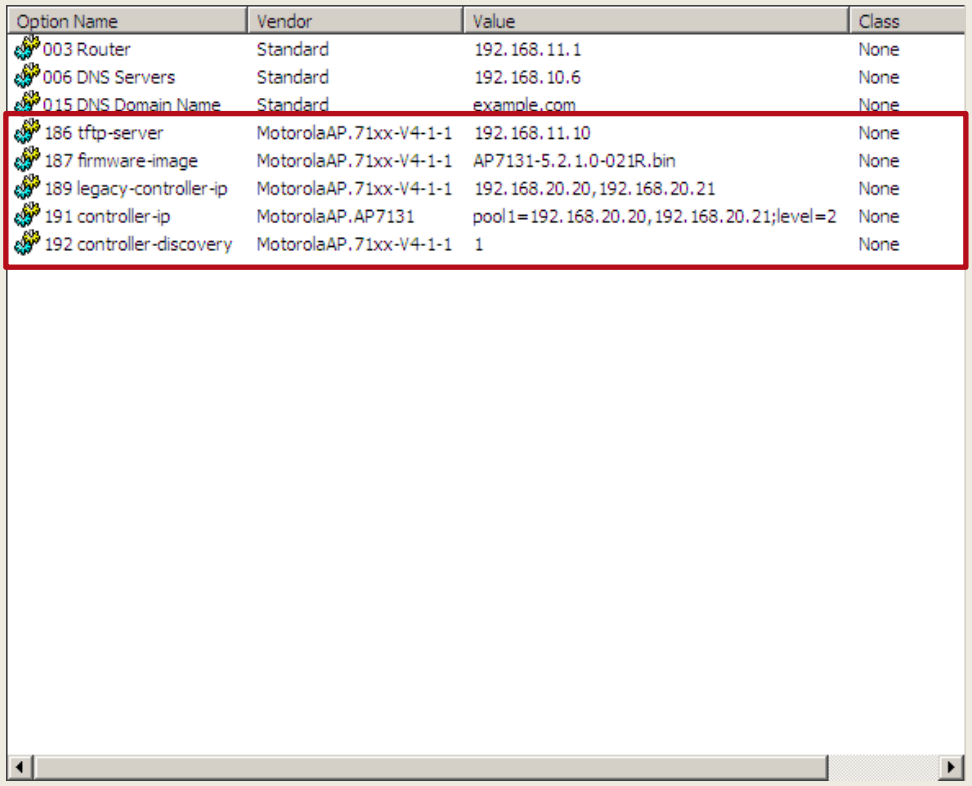
Option Name	Vendor	Value	Class
003 Router	Standard	192.168.11.1	None
006 DNS Servers	Standard	192.168.10.6	None
015 DNS Domain Name	Standard	example.com	None
186 tftp-server	MotorolaAP.71xx-V4-1-1	192.168.11.10	None
187 firmware-image	MotorolaAP.71xx-V4-1-1	AP7131-5.2.1.0-021R.bin	None
189 legacy-controller-ip	MotorolaAP.71xx-V4-1-1	192.168.20.20,192.168.20.21	None
191 controller-ip	MotorolaAP.AP7131	pool1=192.168.20.20,192.168.20.21	None
192 controller-discovery	MotorolaAP.71xx-V4-1-1	1	None

2.1.3.5 AP7131 Centralized Controllers Deployments

The following Linux ISC DHCP server example can be followed to support AP7131 Independent Access Points for local Wireless Controller deployments. Note that this example leverages the vendor class identifier supported by the AP7131 Independent Access Points and will supply specific options to the Access Points based on their WiNG version:

1. Motorola DHCP option 186 is defined as a vendor option to provide the AP7131 Independent Access Points running WiNG 4 with the migration image filename.
2. Motorola DHCP option 187 is defined as a vendor class option to provide AP7131 Independent Access Points running WiNG 4 with the TFTP server address where the migration image is hosted.
3. Motorola DHCP option 189 is defined as a vendor class option to provide AP7131 Dependent Access Points running WiNG 4 with the Wireless Controller IP addresses.
4. Motorola DHCP option 191 is defined as a vendor class option to provide AP7131 Dependent Access Points running WiNG 5 with the Wireless Controller IP addresses and MiNT link level.
5. Motorola DHCP option 192 is defined as a vendor class option to determine how AP7131 Dependent Access Points running WiNG 4 discover the Wireless Controllers.

Example:



Option Name	Vendor	Value	Class
003 Router	Standard	192.168.11.1	None
006 DNS Servers	Standard	192.168.10.6	None
015 DNS Domain Name	Standard	example.com	None
186 tftp-server	MotorolaAP.71xx-V4-1-1	192.168.11.10	None
187 firmware-image	MotorolaAP.71xx-V4-1-1	AP7131-5.2.1.0-021R.bin	None
189 legacy-controller-ip	MotorolaAP.71xx-V4-1-1	192.168.20.20,192.168.20.21	None
191 controller-ip	MotorolaAP.AP7131	pool1=192.168.20.20,192.168.20.21;level=2	None
192 controller-discovery	MotorolaAP.71xx-V4-1-1	1	None

2.2 DNS Server Examples

2.2.1 Bind DNS Server Example

The following DNS A records can be defined on a Bind DNS server to support mixed AP300 / AP650 Dependent and AP7131 Independent Access Points performing DNS based discovery:

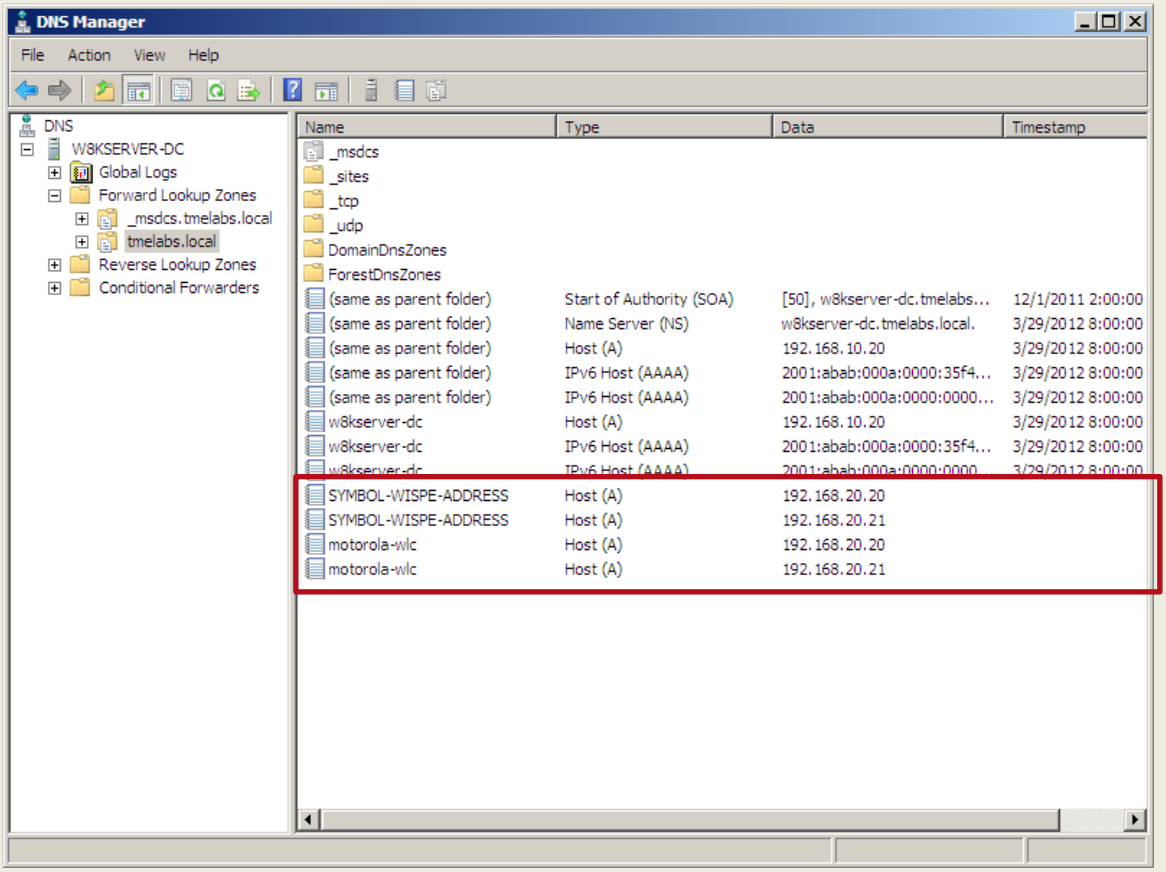
Example:

```
$ttl 38400
tmelabs.local.  IN      SOA     linux-1. kmarshall.motorolasolutions.com. (
                        1325300843
                        10800
                        3600
                        604800
                        38400 )
tmelabs.local.  IN      NS      linux-1.
linux-1.tmelabs.local.  IN      A       192.168.10.6
SYMBOL-WISPE-ADDRESS.tmelabs.local.   IN      A       192.168.20.20
SYMBOL-WISPE-ADDRESS.tmelabs.local.   IN      A       192.168.20.21
motorola-wlc.tmelabs.local.     IN      A       192.168.20.20
motorola-wlc.tmelabs.local.     IN      A       192.168.20.21
```

2.2.2 Microsoft DNS Server Example

The following DNS A records can be defined on a Microsoft DNS server to support mixed AP300 / AP650 Dependent and AP7131 Independent Access Points performing DNS based discovery:

Example:



2.2.3 AP7131 Access Point Profile Example

For centralized Wireless Controller deployments using DNS discovery, the AP7131 Access Point profile requires static controller host entries so that the remote Access Points will establish IP based level 2 MiNT links with the Wireless Controllers once their configuration has been received.

Example:

```
!
profile ap71xx stores-ap7131
 ip name-server 192.168.10.5
 ip domain-name tmelabs.local
 no autoinstall configuration
 no autoinstall firmware
 interface radio1
  wlan STORES-PSK bss 1 primary
  wlan STORES-DOT1X bss 2 primary
 interface radio2
  wlan STORES-DOT1X bss 1 primary
 interface ge1
  description Uplink
  switchport mode trunk
  switchport trunk native vlan 21
  no switchport trunk native tagged
  switchport trunk allowed vlan 21-23
  ip dhcp trust
  qos trust dscp
  qos trust 802.1p
 interface ge1
 interface vlan21
  description Native-VLAN
  ip address dhcp
  ip dhcp client request options all
 controller host 192.168.20.20 level 2
 controller host 192.168.20.21 level 2
 use management-policy stores
 use firewall-policy default
 ntp server 192.168.10.5
 service pm sys-restart
!
```

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